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ABSTRACT

This guide sets forth minimum approval criteria for electrical occupations cluster training programs in Oregon. The information in the guide is intended for use by district-level curriculum planners, teachers, regional coordinators, or state education department staff involved with new program development or revisions of existing programs. The guide outlines the instructional content of electricity and electronics education programs in terms of program descriptions, areas for training (such as electronics assembler, appliance repair person, electronic technician, and electrician), program goals, course/content goals, and sample performance objectives. Course titles and descriptions are also included. A section on organizational options is designed to illustrate a few of the many ways to deliver the minimum instructional content required for an approved vocational cluster program. Content is illustrated by course titles for the instructional levels to recognize that students from different grades may enroll in one or more levels of a program. (KC)

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CLUSTER BRIEF

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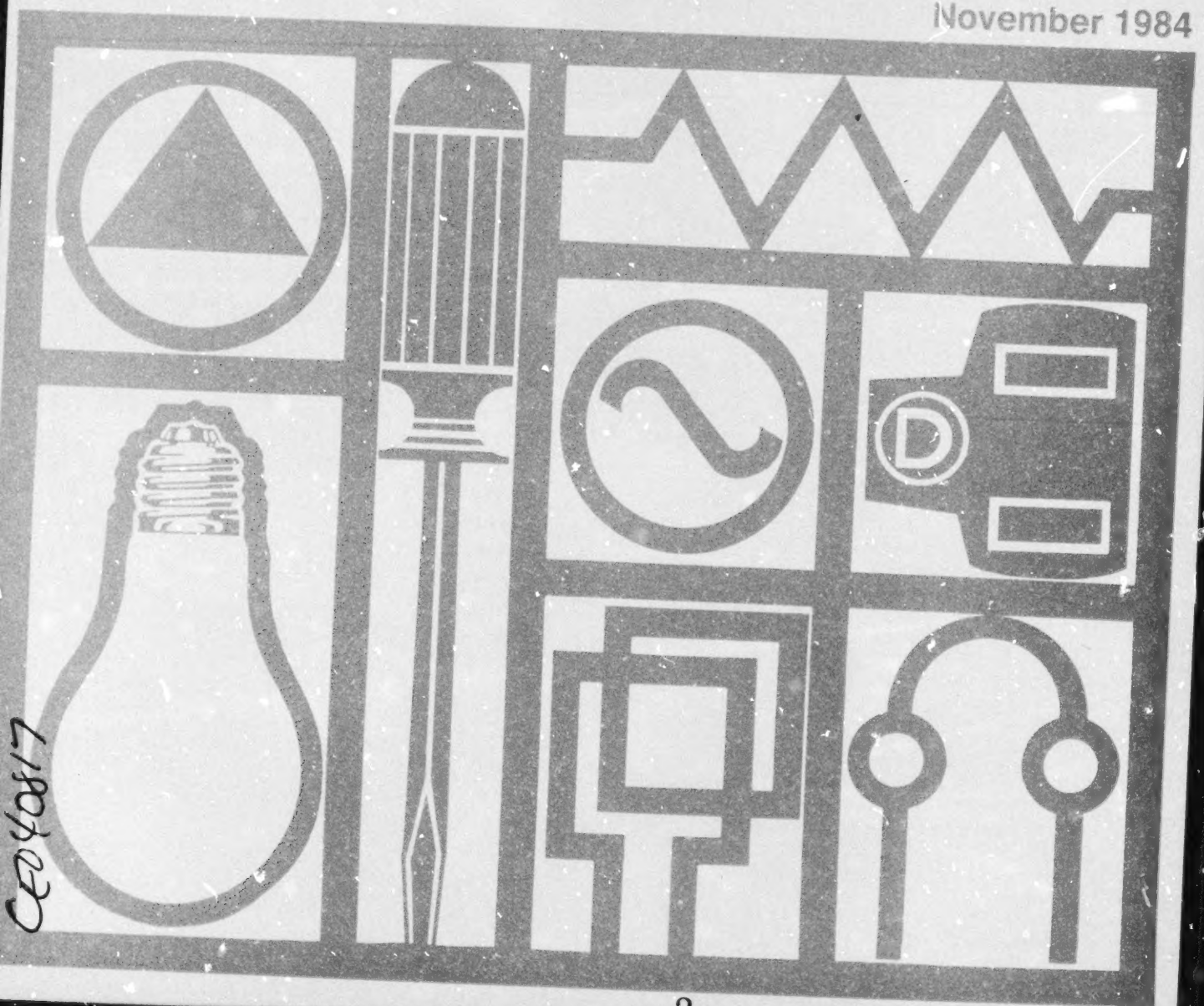
ELECTRICAL OCCUPATIONS

November 1984



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ELECTRICAL OCCUPATIONS VOCATIONAL CLUSTER PROGRAM
MINIMUM APPROVAL CRITERIA

The following information is for use by district-level curriculum planners, teachers, regional coordinators or Department staff involved with new program development or revisions of existing programs. For more information about instructional content, see Cluster Guide for Electrical Occupations - 1977.

The minimum approval criteria for an Electrical Occupations Cluster program are set forth in this document. The instructional content is outlined in terms of program descriptions, areas for training, program goals, course/content goals and sample performance objectives. Course titles and descriptions are also included.

The section on organizational options is designed to illustrate a few of the many ways to deliver the minimum instructional content required for an approved vocational cluster program. Please note that time is illustrated in terms of credits. Content is illustrated by course titles for the instructional level(s) to recognize that students from different grades may enroll in one or more levels of a program.

Program Description

The electrical cluster includes instruction in basic electrical concepts and hand skills required by a variety of electrical-electronic occupations. It stresses application of fundamental arithmetic and scientific concepts and encompasses advanced electronic concepts, troubleshooting, problem solving, technical English and applied advanced mathematics.

Areas for Training

Inside electrician
Maintenance electrician
Electronics assembler
Electrical appliance repair
Electronic service technician
Electronic technician

Program Goals

Students will be able to:

- Know and apply safety practices standard to the electrical industry.
- Communicate in technical terms.
- Apply theoretical electronic, scientific and mathematical concepts to the analysis of a circuit.
- Do practical analysis of electrical/electronic equipment.
- Apply skills in the assembly, maintenance and repair of electrical and electronic equipment.
- Speak, read, and write in a manner which will demonstrate technical maturity and leadership.
- Apply basic leadership skills.
- Apply entrepreneurship skills to the electrical cluster.

Course/Content Goals

TECHNICAL COMMUNICATIONS

Students will be able to:

Use color codes.

Use schematic drawings.

Use layout diagrams.

Use a block diagram.

Use exploded pictorial views.

Use wiring pictorial views.

Use sketches, electrical drawings.

Use blueprints and specifications.

Use drafting dimension systems.

Use equipment manuals.

Interpret nameplate data.

Use data from graphs, tables, and charts.

Keep costs and materials records.

Maintain inventory of materials.

Fill out job/time work sheets.

Complete business forms.

Use parts catalogs.

Phone-in parts orders.

Maintain safety records.

Write formal and informal technical reports.

Consult with inspector, supervisor, peers, etc.

Deal with customers.

Follow written, sequential directions.

Follow oral, sequential directions.

Accomplish speech preparation and delivery.

Use standard schematic symbols.

Use electrical abbreviations.

MEASUREMENT AND EVALUATION

Students will be able to:

Read meters.

Use volt, ohm, milliameter (VOM).

Use vacuum tube volt meter or digital multimeter (VTVM) (DMM).

Use a digital voltmeter.

Use a power supply.

Use signal generators (AF) and (RF).

Use an oscilloscope (General Purpose).

Use an oscilloscope (Laboratory type).

Use a tube tester.

Use a transistor tester.

Use a capacitor tester.

Use an impedance bridge.

Use an amprobe.

Use a substitution box (Resistance and Capacitance).

Use a frequency counter.

Use a megger.

Use an isolation transformer (safety device).

Use a growler.

CONSTRUCTION, INSTALLATION, MAINTENANCE, REPAIR

Students will be able to:

Use correct soldering techniques.

Use proper desoldering techniques.

Properly use hand tools.

Use a micrometer.

Use an electric hand drill and drill press.

Use wire wrapping equipment.

Use a sabre saw.

Use a stud gun.

Use a vacuum pump.

Use a bearing puller and installer.

Perform power tool maintenance.

Use a pipe bender (hickey).

Use flaring tools.

Use cutting and threading tools.

Install an electric service.

Install boxes and panels.

Install conduit, cables, raceways and fittings.

Install/connect grounding devices.

Install/connect fixtures and appliances.

Use wire pulling equipment.

Identify wire and cable by size and color code.

Form cable harnesses.

Lace/strap wire.

Connect wire to terminals.

Prepare and connect cables and wires.

Cut/strip/splice wire and cable.

Identify electronic parts and components.

Assemble, install, and connect switches, transformers, capacitors, subassemblies.

Construct chassis.

Use fastening devices (screws, bolts, rivets).

Inspect/replace protective and control devices (fuses, thermal switches, relays, timers, etc.).

Troubleshoot a series circuit.

Troubleshoot a parallel circuit.

Maintain electrical/mechanical systems.

Adjust/repair small household appliances.

Inspect/replace/repair motors, generators, servos, etc.

Repair refrigeration systems.

Repair washing machines and dryers.

ELECTRICAL/ELECTRONIC THEORY, SCIENTIFIC PRINCIPLES, MATHEMATICS

Students will be able to:

Explain the electron theory.

Explain and calculate voltage.

Explain and calculate current and resistance.

Explain conductors, insulators, and semiconductors.

Explain and calculate Ohm's Law.

Explain and calculate Watt's Law.

Explain and calculate series resistive circuits.

Explain the voltage divider.

Explain and calculate parallel resistive circuits.

Explain and calculate series-parallel resistive circuits.

Explain and calculate Kirchoff's laws.

Explain magnets and magnetic fields.

Explain AC terminology.

Define and calculate sine wave values.

Calculate AC power.

Explain and calculate inductance.

Define and calculate RL time constant.

Define and calculate inductive reactance.

Explain transformers.

Explain and calculate capacitance.

Define and calculate RC time constant.

Define and calculate capacitive reactance.

Measure and calculate series impedance.

Measure and calculate parallel impedance.

Explain resonance.

Measure, define and calculate series resonant circuits.

Measure, define and calculate parallel resonant circuits.

Define and calculate circuit Q and bandwidth.

Explain filter networks.

Describe the DC generator.

Describe the alternator.

Describe the DC motor.

Describe the AC motor.

Explain solid state junctions and diodes.

Use semiconductor diodes.

Explain the zener diode.

Explain the silicon control rectifier (SCR).

Explain the characteristics of transistors.

Explain the characteristics of the field effect transistor (FET).

Explain and calculate amplification.

Explain transistor voltage amplifiers.

Explain power supply rectifiers.

Explain power supply filters.

Manipulate basic arithmetic operations.

Compute fractions.

Compute powers and roots.

Use ratio and proportion.

Use scientific notation.

Compute percent and tolerance.

Calculate db units.

Use algebra.

Solve right triangle problems.

Solve phasor problems.

PERSONAL DEVELOPMENT AND LEADERSHIP

Students will be able to:

Establish and pursue goals based on personal values.

Secure job leads.

Build a personal resume.

Write a letter of introduction.

Interview for a job.

Fill out a job application.

Follow up on an interview.

Discuss reasons for the necessity of organized labor in our society.

Read and interpret a labor contract.

Analyze and suggest solutions to typical human relations problems in work settings.

Demonstrate punctuality and regular work attendance.

Work cooperatively with others.

Demonstrate safe work habits.

Demonstrate desirable attitudes.

Function effectively in a vocational student organization.

Sample Performance Objectives

Given the schematic diagram of a common base amplifier, common emitter amplifier and common collector amplifier, the student will write the distinguishing characteristics of each.

Given the collector curves and loadlines, the student will calculate the operating point, Q, collector, emitter and base current, collector and load voltages, voltage, current and power gains.

Given an emitter amplifier and a set of figures, the student will set up and measure the operating conditions of a common emitter amplifier to verify load line calculations.

Given an amplifier and figures, the student will calculate the voltage, current and power gain of the amplifier.

Given drawing materials, the student will be able to sketch a diagram of the phase relationship between the input and output voltage.

Course Titles and Descriptions

ELECTRICAL CLUSTER I: Instruction for the first year of the electrical cluster should include all of the competencies under all of the content goals which are common to all of the occupations listed in the electrical cluster guide. This training must include all manipulative, recognition and theoretical skills.

ELECTRICAL CLUSTER II: The first semester of the second year of the cluster the student should be allowed a choice to specialize in one or two of the occupations listed in the electrical cluster guide. Specific competencies for the performance of these occupations should be taken from the list provided and the student allowed to train to entry level or for further education as desired. The second semester of the second year should provide the student with cooperative work experiences which enable her/him to apply the classroom/laboratory experiments to real situations.

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Minimum Electrical Vocational Cluster Approval Criteria

In addition to specific cluster criteria, state-approved vocational programs shall meet the criteria for approval of all secondary vocational education instruction as listed in the Handbook of Policies and Procedures for Vocational Education Instruction in Oregon Secondary Schools, 1985.

Criteria outline:

- 4 credits (130 hours of credit) offered:
  - 2 credits each of two years or 4 credits in one year.
- Instructional time blocks of sufficient duration for skill development to meet industry standards.
- Program goals, course goals and instructional content which reflect those in the state cluster brief.
- Provision for occupational cooperative work experience. If offered, it must be in addition to the 4 credit basic instructional program.
- Vocationally certified teacher.
- An active, representative occupational advisory committee.
- Vocational Industrial Clubs of America (VICA) as an integral part of the instructional program.

* *

Organizational Options

There are many acceptable options for delivery of instructional content while assuring that a quality program is provided. Schools have the opportunity to schedule classroom and laboratory activities to accommodate students and to facilitate learning. Delivery options include after school, weekends, summer school or alternate days.

Option	A	B	C
	1-Year	2-Year	3-Year
Level I			Basic Elec. 1 Credit
Level II		Elec. I 2 Credits	Elec. II 2 Credits
Level III	Elec. I-II 4 Credits	Elec. II 2 Credits	Elec. II 2 Credits

* Option D

1 to 3 year program

flexible time
flexible credit

For Option D, 75 percent of enrolled students must pass appropriate student occupational competency achievement test at completion of program with a score equal to or better than national norm. Tests are developed by the National Occupational Competency Testing Institute (NOCTI). Contact NOCTI liaison person, Oregon Department of Education, 378-8376.

If you need technical assistance, call the Occupational Program Specialist at the Department of Education. The specialist's name and phone number appear on the first page of this document.

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